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MEMORANDUM REPORT

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DEVELOPMENT OF R. F. SIGNAL GENERATOR
TS-413 (XA-A) U

MCREE-48-55 15 SEPTEMBER 1948

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ELECTRONIC SUBDIVISION

ENGINEERING DIVISION
AIR MATERIEL COMMAND—U. S. A. F.
WRIGHT-PATTERSON AFB., DAYTON, OHIO

ABSTRACT

DEVELOPMENT OF R.F. SIGNAL GENERATOR TS-413(XA-A)/U. (AMC Engineering Memo. Report MCREE-48-55, 15 September '48. GEORGE M. Myron, Elec. Subdivision Communication and Navigation Laboratory, Wright Field.) The r-f signal generator was developed in order to provide a rugged generator for field use by the U.S.A.F. This report is being issued as a supplement to Memorandum Report Serial No. TSELC5-188, dated 8 October 1947. Earlier unsatisfactory samples submitted by the contractor were modified, resubmitted, inspected and tested. The results of the inspection and tests of the resubmitted samples are given in this report. It was concluded that the signal generator is satisfactory for field use. It was recommended that the signal generator be adopted as a standard item for use by the U.S.A.F.
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HEADQUARTERS
AIR MATERIEL COMMAND
WRIGHT-PATTERSON AIR FORCE BASE
DAYTON, OHIO

MEMORANDUM REPORT ON

SUBJECT: Laboratory Test of TS-413(XA-A)/U R.F. Signal Generator (Nos. 2cg, 3cg, 4cg and 5cg)

DATE: 15 Sept 48

OFFICE: Comm. & Nav. Laboratory

Contract No. W33-038-ac-9216

SERIAL NO: MCREE-48-55

Expenditure Order No. 110-30

A. PURPOSE

1. The purpose of this investigation was to test Signal Generator TS-413(XA-A)/U units delivered by General Electric Co. on Contract No. 33-038-ac-9216, in order to ascertain: (a) whether or not certain deficiencies previously reported within Memorandum Report TSELC5-188 (dated 8 October 1947) had been corrected by the contractor, and (b) whether or not the generators could be considered to be satisfactory for field use by the U.S.A.F.

B. FACTUAL DATA

2. R.F. Signal Generator TS-413(XA-A)/U unit number 3cg was re-submitted for test approximately 15 May 1948. The remaining three units (numbers 2cg, 4cg, and 5cg) were re-submitted for test on approximately 15 June 1948. Testing of the re-submitted units was completed approximately 20 July 1948.

3. Tests to which the units were subjected:

a. Unit No. 3cg.- The generator was subjected to a brief operational test in order to determine its ability to perform its intended functions. Following the operational check the generator was forwarded to the National Bureau of Standards, Washington, D. C.

(1) National Bureau of Standards measured the output voltage of the 1 volt and .1 volt ranges of the generator under the following conditions:

(a) The impedance of the measuring probe was kept extremely high and therefore presented a negligible load to the generator.

(b) The output voltage measurement was made at the panel jacks of the generator.

(c) The meter switch of the output voltmeter was kept in the panel position marked 1.

(d) The measurement was made for each of the two output ranges when the r-f gain of the unit was adjusted so as to cause the output voltmeter to read 1.

(2) The output voltage of the attenuator ranges from the .01 volt thru the 10 microvolt range was checked by use of the National Bureau of Standards standard attenuators and the substitution method. Bureau of Standards indicated that the precision of each measurement was such that the accuracy of the result was within ±3% of the true value of the parameter under measurement.

b. Unit No. 4cg.- The generator was subjected to a brief operational test in order to determine its ability to perform its intended functions. Following a twenty minute warm-up period, under normal room conditions, one point on each frequency range was checked against a BC-221-AA frequency meter (Serial No. 187). The generator was placed in the Test Branch temperature-humidity chamber and exposed to 32 of the temperature-humidity cycles described in Specification No. 71-5056. Approximately once each 48-hour period the unit was energized and permitted to warm up for a 20 to 30 minute period. Following each warm-up period, one point on each frequency range was checked against the BC-221-AA frequency meter.

c. Unit No. 2cg.- The generator was inspected in order to insure that previously observed defective components had been replaced. Following this it was operated for a brief period of time in order to determine its ability to perform its intended functions.

d. Unit No. 5cg.- The generator was subjected to a brief operational test for a period of time in order to check its ability to perform its intended functions. Following this the generator was inspected in order to ascertain:

(1) Whether or not the deficiencies previously reported within Memorandum Report No. TSELC5-188, (dated 8 October 1947) had been corrected.

(2) The method used by the contractor to correct the previously reported deficiencies.

4. Results of tests to which the units were subjected.

a. Unit No. 3cg.- Data concerning the output voltage of the generator which was received from the National Bureau of Standards are shown in Exhibit A. It shows that the design of the attenuator of the generator was such that it satisfied the requirements of paragraph E-2d of the applicable specification.

b. Unit No. 4cg.- The data observed during the 32-day temperature-humidity test are shown in Exhibit B. It shows that the generator was designed in such a manner as to enable it to successfully withstand 32 days of exposure to the temperature-humidity conditions required by Specification No. 71-5056.

c. Unit No. 2cg.- Inspection of the generator showed that all of the previously observed defective components had been replaced and that the generator was in good working condition.

d. Unit No. 5cg.- The detailed inspection of the generator showed the following:

(1) The undesirable phenomenon which was previously reported in paragraph 5a(2) of Memorandum Report No. TSELC5-188 (A.F. voltmeter indicating approximately .08 volt even though no A.F. modulation signal was applied across the input to the meter) was found to have been corrected. Each of the two 4 mfd capacitors in the power supply filter had been replaced by units of higher capacitance values. The additional filtering thus provided corrected the undesirable phenomenon noted above.

(2) The undesirable phenomenon which was previously reported in paragraph 5a(3) of Memorandum Report No. TSELC5-188 (R.F. voltmeter pointer varying its position proportional to power supply line voltage changes) was found to have been corrected. The original 6J6 tube in the voltmeter circuit was replaced with a new 6J6 tube. Following such action the undesirable phenomenon noted above was found to have been eliminated.

(3) Paragraph E-2d of the applicable specification requires that under no load conditions TS-413(XA-A)/U R.F. Signal Generators shall be capable of producing an output signal of at least 1 volt amplitude at any frequency throughout the frequency range of 75 kc to 40 mc. It was found that corrective action had been taken by the con-

tractor and that the TS-413(XA-A)/U R.F. Signal Generator was, when resubmitted, capable of producing a 1 volt output. Correction of the previously noted undesirable low voltage output of the TS-413(XA-A)/U R.F. Signal Generator (See paragraph 5b(1) of Memorandum Report No. TSELC5-188) was obtained by removing the 6L6-6A power tube in the output stage and replacing that tube with a 6AG7 type of tube. The 6AG7 tube provides sufficient amplification at the higher frequencies so as to enable the TS-413(XA-A)/U R.F. Signal Generator to produce the necessary 1 volt output.

(4) It was found that the control shafts of the various controls had been redesigned and had been constructed of a new type of glass base phenolic resin material. The new control shafts were of such a design that they were capable of performing their intended functions satisfactorily both during and following the 32-day temperature-humidity test. In other words, the unsatisfactory phenomena which were previously reported in paragraph 5b(2) of Memorandum Report No. TSELC5-188 were found to have been corrected.

(5) The undesirable microphonic effects which had been reported previously in paragraph 5(b)(5) of Memorandum Report No. TSELC5-188 were found to have been corrected.

C. CONCLUSIONS:

5. A study of the data obtained during the inspection of the four TS-413(XA-A)/U R.F. Signal Generators following modification and redesign of the units by the contractor has led to the following conclusions:

a. The resubmitted TS-413(XA-A)/U R.F. Signal Generators are designed in such a manner as to enable them to operate satisfactorily both during and following exposure to 30 of the temperature-humidity cycles described within USAF Specification No. 71-5056.

b. The contractor has corrected the various deficiencies which were previously reported within Memorandum Report No. TSELC5-188.

c. The resubmitted TS-413(XA-A)/U R.F. Signal Generators are constructed in such a manner as to enable them to meet the requirements of the specifications covering the item.

D. RECOMMENDATIONS:

6. It is recommended that the resubmitted models of TS-413(XA-A)/U R.F. Signal Generator be accepted by the Government.

7. Inasmuch as the TS-413(XA-A)/U R.F. Signal Generator is, to the best knowledge available within this Laboratory, the most rugged instrument of its kind available at the present time, it is recommended that the item be designated as standard for U.S.A.F. field use.

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GEORGE M. MYRON, Radio Engineer

APPROVED BY Lester Q. Hendricks
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Chief, Electronic Subdivision
Engineering Division

COPY OF DATA OBTAINED FROM THE NATIONAL BUREAU OF STANDARDS

Note: With R.F. output voltmeter indicating 1 and with the measurement being made under virtual no-load conditions, the output voltage at the appropriate panel jacks of the generator numbered 3cg. was as shown in the chart below. Room Temperature = 22° C

Frequency Band of Generator	Frequency Range of Band	Frequency At Which Output Voltg. Measurement Was Made	Output Voltage at 1 v. Jack	Output Voltage at Attenuator Jack-Switch in 100 K position.	Output Voltage at Attenuator Jack-Switch in 10 K position.	Output Voltage at Attenuator Jack-Switch in 1 K position.	Output Voltage at Attenuator Jack-Switch in 100 position.	Output Voltage at Attenuator Jack-Switch in 10 position.
Band 1	75 to 235 kc	160 kc	1.02	.096	.0097	.00096	.000096	.0000096
		235 kc	1.01	.094	.0092	.00093	.000093	.0000093
Band 2	225 to 660 kc	350 kc	1.01	.094	.0092	.00091	.000092	.0000092
		637 kc	1.01	.095	.0094	.00095	.000094	.0000094
Band 3	.645 to 1.95 mc	1.3 mc	.99	.093	.0091	.00092	.000093	.0000093
		1.45 mc	1.01	.093	.0092	.00093	.000094	.0000094
Band 4	1.8 to 5.6 mc	3.7 mc	1.00	.094	.0093	.00094	.000096	.0000096
		5.6 mc	1.00	.092	.0091	.00092	.000092	.0000092
Band 5	5.3 to 17.5 mc	11.4 mc	1.02	.096	.0097	.00096	.000097	.0000097
		17.5 mc	.98	.091	.0091	.00092	.000092	.0000092
Band 6	16.5 to 42	29.5 mc	1.00	.091	.0092	.00094	.000094	.0000094
		42 mc	1.02	.093	.0094	.00096	.000096	.0000097

MCREEC-48-55
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EXHIBIT A

MCREEC-48-55
15 Sept 48

FREQUENCY DATA TAKEN DURING 32-DAY TEMPERATURE-HUMIDITY TEST OF TS-413(XA-A)/U R.F. SIGNAL GENERATOR No. 4cg

Date of Test	TS-413(XA-A)/U Dial Setting Was 125 kc Vernier was 30	TS-413(XA-A)/U Dial Setting Was 250 kc Vernier was 74	TS-413(XA-A)/U Dial Setting Was 8 mc Vernier was 17	TS-413(XA-A)/U Dial Setting Was 2.4 mc Vernier was 40	TS-413(XA-A)/U Dial Setting Was 7.0 mc Vernier was 40	TS-413(XA-A)/U Dial Setting Was 19.5 mc Vernier was 1
	Output Frequency - kc*	Output Frequency - kc*	Output Frequency - mc *	Output Frequency - mc *	Output Frequency - mc *	Output Frequency - mc*
18 Jun 48	125.2	250.3	.7987	2.399	7.017	19.505
21	124.4	247.6	.7857	2.360	7.001	19.471
22	123.7	246.3	.7822	2.352	7.001	19.483
23	123.3	246.6	.7826	2.348	6.945	19.480
24	122.8	244.8	.7794	2.338	6.986	19.488
25	122.5	243.5	.7762	2.319	6.980	19.476
25	122.8 +	246.0 +	.7863 +	2.344 +	6.991	19.463 +
28	124.0	247.0	.7875	2.346	6.994	19.493
29	122.9	245.7	.7841	2.341	6.985	19.482
30	122.7	245.1	.7831	2.338	6.986	19.464
1 Jul 48	122.4	244.3	.7812	2.334	6.987	19.468
2	122.0	243.7	.7791	2.320	6.977	19.454
6	121.9	243.5	.7789	2.313	6.973	19.462
7	122.1	244.2	.7800	2.319	6.975	19.471
9	122.2	244.2	.7804	2.318	6.975	19.465
12	122.1	245.7	.7805	2.319	6.980	19.478
14	121.8	243.7	.7794	2.315	6.970	19.478
16	122.3	245.2	.7843	2.328	6.979	19.464
19	122.6	245.8	.7848	2.321	6.987	19.475

* As measured by a BC-221-AA Frequency Meter (Serial No. 187) following a 30 minute warmup period.
\+ As measured by a BC-221-AA Frequency Meter (Serial No. 187) following a warmup period of 3 hours.

EXHIBIT B
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